

Gear Efficiencies in the Fish Component of the Long Term Resource Monitoring Program: Predicted Versus Observed Catch

By Brian S. Ickes

Environmental monitoring programs are frequently designed to track changes in key physical, chemical, and biological features of an ecosystem. As such, these programs provide critical information for detecting changes in system state, investigating mechanisms associated with observed changes, and making resource management decisions. Because monitoring programs require significant investments of time, money, and human resources, periodic evaluations of monitoring programs are necessary to determine if the sampling design adequately addresses program goals and objectives. Periodic evaluations also permit assessment of a program's ability to provide adequate and useful information for changing management and science needs.

In 2001, we evaluated the Long Term Resource Monitoring Program (LTRMP) sampling design for fish on the Upper Mississippi River System by analyzing data from stratified random samples collected during 1993–1999 in six Resource Trend Areas (RTA; Figure). Specifically, we investigated whether the sampling design could provide nearly the same amount of information it presently does with fewer sampling gears. Results and recommendations are in Ickes and Burkhardt (2002); available at <http://www.umesc.usgs.gov/documents/reports/2002/02t001.pdf>. Our goals were to assess information provided by each gear used to monitor fishes in the LTRMP, engage program partners in a discussion on the relative value of each gear within the present sampling design, develop alternative sampling designs based on simulations of historical program data and expert opinion, and optimize the implementation of various alternative designs. Following our investigation and consultation with program partners, we eliminated 4 of the 10 gears used since program initiation in 1989.

Collections from 2002 provided the first opportunity to assess the accuracy of our predictions. We were unable to incorporate additional contemporary data because sampling was curtailed in the northern RTAs in 2003, and curtailed for the full program in 2004. These reductions were budget driven and independent of studied and planned gear reductions implemented in 2002. Thus, data deriving from 2003 and 2004 have questionable value in a prediction validation context for assessing the quantitative effects of 2002 gear reductions. Based on simulations of program data from 1993 to 1999, our investigation in 2001 predicted that a six-gear design would retain 65% of historical annual catch, but with considerable variation among RTAs (Table 1). In 2002, total program catch was more than 2 times greater than predicted from historical data simulations. Three RTAs observed higher than predicted total annual catches (Pools 13 and 26 and La Grange



Figure. The Upper Mississippi River System and locations of the six Resource Trend Areas monitored by the Long Term Resource Monitoring Program.

Pool) and three observed lower than predicted catches (Pools 4 and 8 and Open River). Much of the difference between predicted and observed total annual catch, for the entire program and among RTAs, was because the largest gizzard shad (*Dorosoma cepedianum*) and threadfin shad (*D. petenense*) catches on record occurred in 2002.

During our evaluation in 2001, we also predicted that annual collections under the six-gear design should result in 9% reduction in the total number of species collected annually for the entire program (Table 2). As predicted, the fish component observed an overall 9% reduction relative to the historical average. However, differences between predicted and observed annual species counts varied among RTAs. Annual species counts in 2002 were below predictions for Pools 4, 8, and 26 and Open River, whereas in La Grange Pool we observed the same number as predicted, and in Pool 13 we observed one more species than predicted. It is difficult to place these deviations into context with only 1 year of post-design change data. We do expect annual species counts to vary over time because all of the predicted losses in annual species detection were associated with species

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uncommon in the catch, making their detection uncertain for any given year.

The value of changes to a monitoring network must be weighed against the costs of ceasing to collect particular types of data. Periodic evaluations of monitoring data force those responsible for implementing a program to critically assess the scientific and fiscal performance of the monitoring network. It also encourages users of program data to critically assess the value of the information provided in the context of their management and science needs. Such reflection is the foundation of an adaptive, partnership program. Details of the options considered by the partnership and subsequent analyses are in Ickes and Burkhardt (2002). The reductions in fish sampling gear implemented by the

LTRMP in 2002 resulted in savings of time, effort, and money, with little apparent loss of information. Thus, the evaluation process used to assess these changes appears to have been successful in creating efficiencies within the Program while still achieving program goals.

Ickes, B. S., and R. W. Burkhardt. 2002. Evaluation and proposed refinement of the sampling design for the Long Term Resource Monitoring Program's fish component. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, Wisconsin, October 2002. LTRMP 2002-T001. 17 pp. + Appendixes A–E. CD-ROM included. (NTIS #PB2003-500042)

Table 1. For each Resource Trend Area (RTA) within the Long Term Resource Monitoring Program (LTRMP), the mean annual total catch of fish under 10-gear sampling design from 1993 to 1999, and the predicted and observed catch under the 6-gear sampling design implemented in 2002. Numbers in parentheses are the percentage of the total catch under the 10-gear sampling design that was predicted and observed in 2002 under the 6-gear sampling design

RTA	Mean Annual Total Catch		
	10-gear design	Predicted 6-gear design	Observed 6-gear design
Pool 4	68,857	46,857 (68%)	36,945 (54%)
Pool 8	54,000	26,143 (48%)	22,574 (42%)
Pool 13	46,571	17,714 (38%)	36,750 (79%)
Pool 26	25,429	18,286 (72%)	47,820 (188%)
Open River	17,571	17,143 (98%)	11,804 (67%)
La Grange Pool	83,286	67,000 (80%)	270,905 (325%)
Total	295,714	193,143 (65%)	426,798 (144%)

Table 2. For each Resource Trend Area (RTA) of the Long Term Resource Monitoring Program (LTRMP), the number of fish species collected each year and the seven-year annual mean under the 10-gear design, 1993 – 1999, and the predicted and observed number of species under the 6-gear design in 2002 along with the difference between the numbers predicted and observed (percent deviance from the 7-year mean in parentheses).

Year	Resource Trend Area						
	Pool 4	Pool 8	Pool 13	Pool 26	Open River	La Grange	Program Total
10-gear design							
1993	73	78	65	62	66	64	111
1994	74	75	61	62	61	63	107
1995	59	72	61	70	72	68	108
1996	66	75	59	67	67	69	111
1997	71	76	67	66	67	66	113
1998	68	75	65	63	63	75	115
1999	73	72	69	67	71	65	114
Average (1993-1999)	69	75	64	65	67	67	111
6-gear design in 2002							
Predicted	64 (-7%)	70 (-7%)	58 (-9%)	62 (-5%)	65 (-3%)	67 (-0%)	101 (-9%)
Observed	58 (-16%)	65 (-13%)	59 (-8%)	59 (-9%)	63 (-6%)	67 (-0%)	101 (-9%)
Difference	-6	-5	+1	-3	-2	0	0

For more information contact

Brian S. Ickes
U.S. Geological Survey
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Road
La Crosse, Wisconsin 54603
Telephone: 608-781-6298
E-Mail: bickes@usgs.gov
<http://www.umesc.usgs.gov>



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